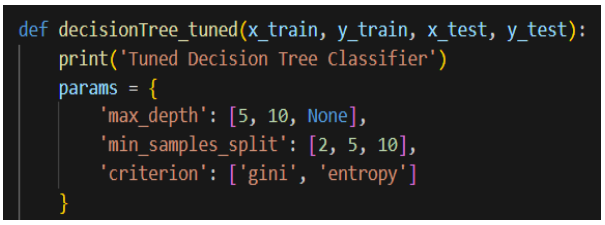
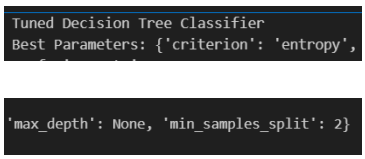
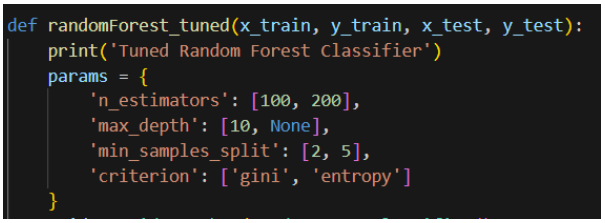
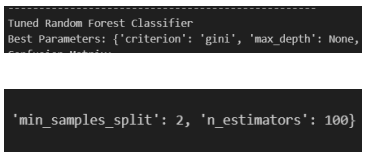
Model Optimization and Tuning Phase

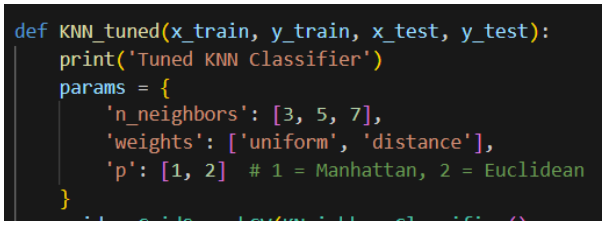
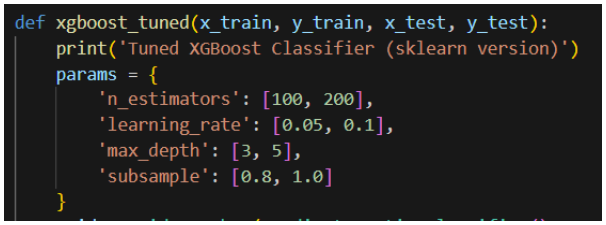
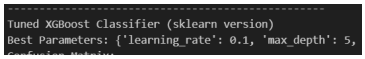
Date	14 June 2025
Team ID	SWTID1749627644
Project Title	Human Resource Management: Predicting Employee Promotions using Machine Learning
Maximum Marks	10 Marks

Model Optimization and Tuning Phase

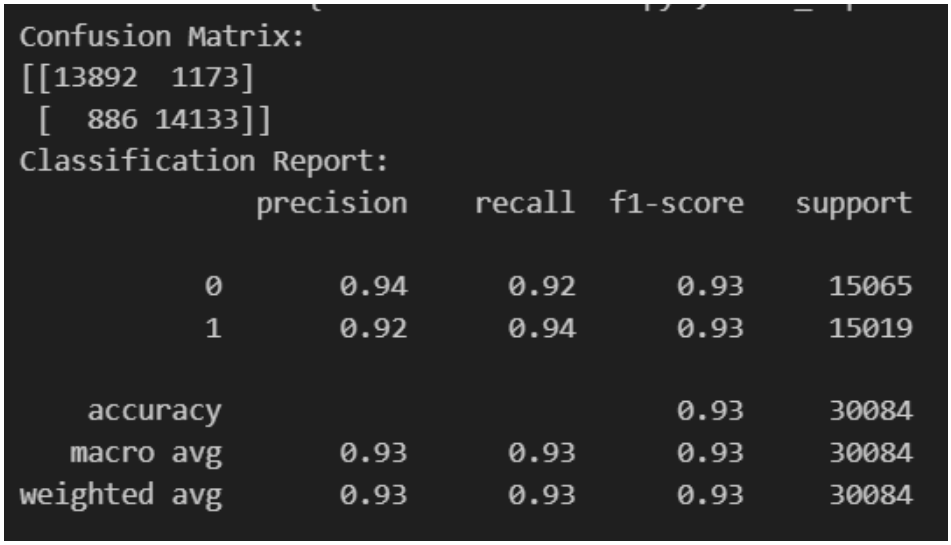
The Model Optimization and Tuning Phase involves refining machine learning models for peak performance. It includes optimized model code, fine-tuning hyperparameters, comparing performance metrics, and justifying the final model selection for enhanced predictive accuracy and efficiency.

Hyperparameter Tuning Documentation (6 Marks):

Model	Tuned Hyperparameters	Optimal Values
Decision Tree Classifier		
Random Forest Classifier		

KNN Classifier		
XGBoost Classifier		 

Performance Metrics Comparison Report (2 Marks):

Model	Optimized Metric
Decision Tree Classifier	

Random Forest Classifier	Confusion Matrix: [[14183 882] [769 14250]] Classification Report: precision recall f1-score support 0 0.95 0.94 0.94 15065 1 0.94 0.95 0.95 15019 accuracy 0.95 30084 macro avg 0.95 0.95 0.95 30084 weighted avg 0.95 0.95 0.95 30084
KNN Classifier	Confusion Matrix: [[12965 2100] [731 14288]] Classification Report: precision recall f1-score support 0 0.95 0.86 0.90 15065 1 0.87 0.95 0.91 15019 accuracy 0.91 30084 macro avg 0.91 0.91 0.91 30084 weighted avg 0.91 0.91 0.91 30084

XGBoost Classifier	Confusion Matrix: [[14195 870] [1781 13238]] Classification Report: precision recall f1-score support 0 0.89 0.94 0.91 15065 1 0.94 0.88 0.91 15019 accuracy 0.91 30084 macro avg 0.91 0.91 0.91 30084 weighted avg 0.91 0.91 0.91 30084

Final Model Selection Justification (2 Marks):

Final Model	Reasoning
Random Forest Model	The Random Forest Classifier performed best with the highest accuracy (95%) and balanced precision and recall, making it both reliable and generalizable. Its ensemble approach reduces overfitting and handles feature interactions better than individual models, leading to consistently strong results across all metrics.